The Influence of Coarseness of Grain on the Lifting Effect of Quicksand

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If the lifting effect of quicksand is a combination of the buoyancy of the water and the upward moving currents of the water (3) the lifting effect of a coarse quicksand should be greater than that of a fine quicksand. Samples of fine sand and coarse sand were placed in the quicksand device, as designed by H. T. Jenkins (2). When upward currents of water were developed with sufficient velocity to make the sand "quick", the lifting effect of the quicksand was measured (a) by an hydrometer and (b) by the line to which a wooden model (Fig. 1) was lifted.

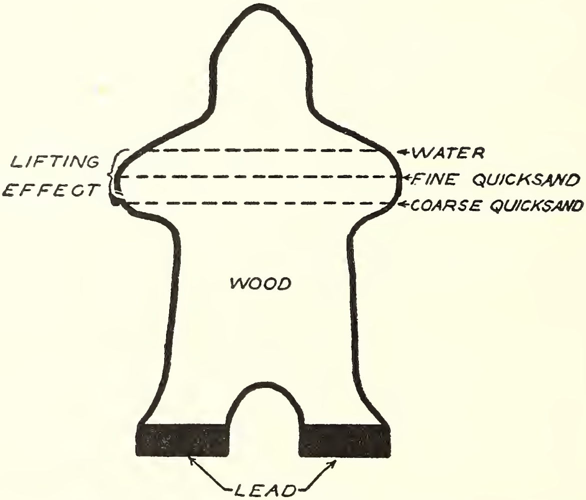

Fig. 1. Comparison of the Lifting Effect of Water, Fine Quicksand and Coarse Quicksand.

The fine quicksand raised the wooden model to the line as shown in figure 1 and exerted the same lifting effect as a liquid with a specific gravity of 1.156 as shown by the hydrometer. Analysis of coarseness of grain of the fine sand (Fig. 2) indicates somewhat greater variability than would be expected in a quicksand which had been exposed to rising currents of water for any great length of time. This sand was artificially crushed and washed Mansfield Sandstone from the abandoned quarry of the American Glass Sand Company, at Fern, Putnam County, Indiana. In a spring with velocity sufficient to lift apart sand grains of between 20 mesh and 60 mesh, doubtless sand grains between minus 200 mesh and 60 mesh would be carried away, resulting in a more uniform diameter of actual quicksand grains. The small number of grains above 20 mesh, on examination with a hand lens, appeared to be finer sand grains cemented into larger aggregates by limonite. In the preparation of the

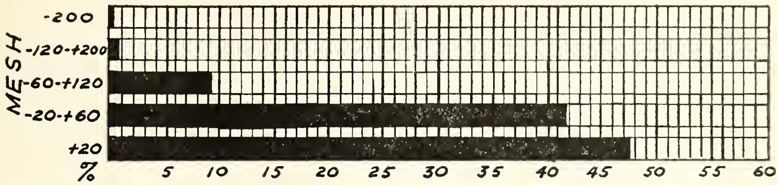

Fig. 2. Grain Analysis of the Fine Quicksand.

glass sand, these had merely not been broken down as completely as the rest of the grains.

The coarser sand studied was a mortar sand from Big Walnut Creek near Greencastle, Putnam County. The distribution of its grain size is shown in figure 3. As in the case of the finer sand, doubtless there is much greater variability of size than would be shown had this sand been exposed to rising currents for a much longer time. Doubtless sand etc. finer than 20 mesh would have been completely carried away. Both of these sands, although very "quick" in the presence of rising currents

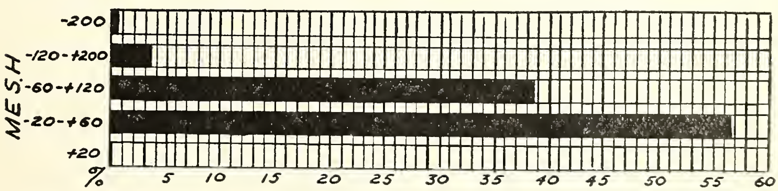

Fig. 3. Grain Analysis of the Coarse Quicksand.

of sufficient velocity, were very compact when dry or moist and showed but little tendency to roundness under a microscope, although no effort was made to determine the "roundness" according to the system suggested by Cox. (1, p. 180)

This coarser sand, when made "quick" by rising currents of water, showed a lifting effect equal to the buoyancy of a liquid with specific gravity of 1.70 and lifted the wooden model to the line shown in figure 1.

The evidence derived from the study of the lifting effect of these two sands is considered to support the suggestion previously made that the lifting effect of a quicksand is a combination of the buoyancy of the water and its upward movement.

References Cited

1. Cox, E. P., 1927. A Method of Assigning Numerical and Percentage Values to the Degree of Roundness of Sand Grains. J. Paleontology, **1**:179 et seq.

2. Smith, Ernest Rice, 1946. Sand. Proc. Ind. Acad. Sci., **55**:121-143.

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A Study of the Supposed Suction Effect of Quicksand

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It would seem a sheer waste of time to study a supposed suction effect of quicksand in view of the evidence brought out in the preceding paper on "The Influence of Coarseness of Grain on the Lifting Effect of Quicksand." Yet even in the presence of data indicating a lifting effect equal to the buoyancy of liquids with a specific gravity of 1.156 to 1.7, still the question arises in the minds of certain geologists—Will not hollows in the human body and in clothing of victims develop such a partial vacuum as to make it relatively difficult to escape from quicksand once a person or other animal is engulfed? Experience with a large

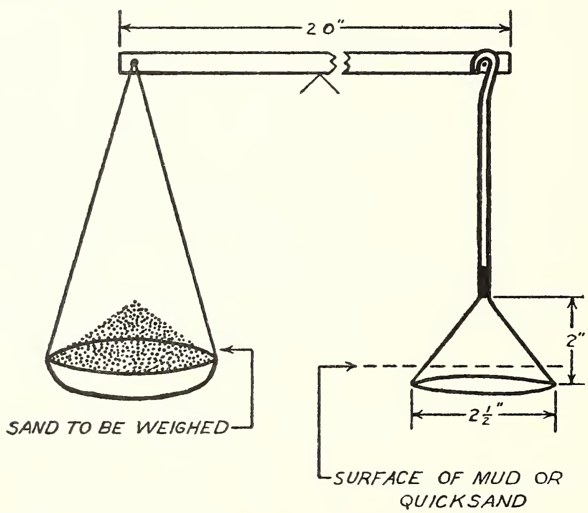

Fig. 1. Apparatus for Comparison of the "Suction Effect" of Mud and Quicksand.

crystal of garnet without such hollows was considered to be indecisive, although it could be extricated so much more easily from sand, made "quick" by rising currents, than from the same sand, merely damp.

To study the influence of such points of partial vacuum the device as depicted in figure 1 was constructed. The inverted funnel on the right, after the opening at the top of the funnel had been fused tightly, was partially immersed in a sticky clay mud and in the two quicksands discussed in the previous paper. At the beginning of each test, the beam was placed on the fulcrum so that the beam was horizontal. Then sand was poured slowly into the pan until the funnel was pulled out of the immersing material. The amount of sand required was then weighed to give an indication of the suction effect of the immersing material, clay mud or various coarsenesses of quicksand. The average required weight of sand to lift the funnel from the mud was 152.7 gms. There is possibly some variation due to variability of viscosity of the mud which would lose some water due to evaporation in the drier-than-Yuma atmosphere of the laboratory. The amount of sand required to draw the funnel from the fine quicksand was but 16.5 gms., average of three tests. With the coarse quicksand, the lifting effect was so great that the bar could not even be set horizontal.

As a result of these studies, the writer believes that there is no suction effect in quicksand comparable to that in mud, and that the coarser the quicksand the less the so-called suction effect.